UNITED STATES PATENT OFFICE.

GEORGE B. GRANT, OF CAMBRIDGE, MASSACHUSETTS.

IMPROVEMENT IN CALCULATING-MACHINES.

Specification forming part of Letters Patent No. **138,245**, dated April 29, 1873; application filed December 30, 1872.

To all whom it may concern:

Be it known that I, GEO. B. GRANT, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Calculating-Machines, of which the following is a specification:

This machine is similar to the one for which I received a patent dated July 16, 1872, No. 129,335, but, as all the parts have been more or less changed, I shall describe it anew without reference to the specification of that patent.

Upon this machine all calculations are reduced to addition, more or less compounded to suit the various requirements; and it therefore consists of mechanism by which a fixed or constant number may be added to a varying one any number of times in succession.

The fixed number is set up on the plate P, which slides in guides *g g'* on the top of the machine. The varying number is shown on the set of wheels under the plate, and the addition of the two numbers is accomplished by the mechanism on the moving carriage C, which is turned by the handle H. The curved plate or "indicator" is furnished with several rows of holes or with slots, in any part of which a pin, *p*, may be fixed which projects through the plate. The rows or slots are numbered from below upward from 1 to 9, and the fixed number is set up by moving the pins to the figures of that number, the lowest slot representing units, the next tens, and so on. The number thus indicated is multiplied or divided by ten if the plate be moved up or down one space equal to the distance between the slots. The spaces and half-spaces are marked upon the guides *g'* by large and small nicks *n'* and *n''*, and the plate is held at any nick by the click *k*. The holes or slots are also marked with another set of smaller figures, which are complements of the larger ones, and are used in some cases in setting up a negative number, as the minuend or divisor. The secondary pins *p'* are placed half way between the others, and their use will be explained further on. The wheels A B C, &c., are placed directly under the slots in the plate, and each wheel is divided into two or, preferably, three sets of ten teeth each, each tooth being marked with a figure. The wheel may take any shape, but is preferably a ring with a wide tire, Figs. 3 and 4, upon which the figures are marked, and upon one side of which the teeth are made. The ring may be dispensed with and the tire alone retained, as sketched in Fig. 9, the pieces *e* moving in the channels and keeping it in position. The carriage C is moved by the handle H, and is provided with drivers *d*, one driver for each wheel. The driver, Fig. 5, is slightly movable sidewise, and, when not in action, moves in the space between the wheels, but when thrown between the teeth of the wheel by any means it moves it till it comes to the piece *l*, Fig. 2, which throws it back into the space. The figures on the slot correspond to the teeth of the wheel below, and when a pin is placed at any figure—seven, for instance—it will be struck by the driver at a distance of seven teeth from *l*. The pin thus throws the driver onto the wheel, so that it shall add to it the number that it is placed at on the slot. The driver is pointed where the pin strikes it, and, if struck on the right, will be thrown on, and, if on the left, off the wheel. If the plate is in a small or negative nick, the pin will strike to the left of the driver and will throw it off if it be on. The secondary pin *p'* will strike the right of the driver when the plate is in a small nick, and will throw it on to be thrown off by the pin *p* after having added a number, which is the complement of the figure *p* is placed at. This is one way in which the subtraction of a number can be effected, and the number set up is either added or subtracted from that on the wheels at every turn of the handle. Subtraction is also effected by setting up the minuend according to the smaller figures on the slots, as its complement would then be added; and by this method the same number would be added by placing the plate in the smaller nicks. The left side of the driver is made lower than the right, and the secondary pins shorter than the others, as it is only in subtraction that both pins are used.

Before commencing an operation the wheels must be all set to zero, and an apparatus is provided to erase whatever figures are on it at one motion of the hand. The wheels are provided with pins *p*, projecting a short distance from their faces, and on the carriage is